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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/821,928	04/12/2004	Jessica Miriam Sunshine	SAIC0056-CON2	2133
27510	7590	10/21/2004	EXAMINER	
KILPATRICK STOCKTON LLP			DASTOURI, MEHRDAD	
607 14TH STREET, N.W.			ART UNIT	PAPER NUMBER
WASHINGTON, DC 20005			2623	

DATE MAILED: 10/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/821,928	Applicant(s) SUNSHINE ET AL.	
	Examiner Mehrddad Dastouri	Art Unit 2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on April 12, 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 27-42 is/are pending in the application. _____
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 27-42 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 27-42 are rejected under the judicially created doctrine of double patenting over Claims 1-26 of U. S. Patent No. 6,608,931, and Claims 1-21 of U.S. Patent 6,741,740, since the claims, if allowed, would improperly extend the "right to exclude" already granted in the patent.

The subject matter claimed in the instant application is fully disclosed in the U. S. Patent No. 6,608,931 and is covered by the patent since the patent and the application are claiming common subject matter as follows:

a process for determining candidate spectral endmember that represents a group of N spectra by defining a metric value range, wherein the N spectra having first metric values within the metric value range are defined as M spectra;

comparing each of the M spectra to determine the frequency with which each of the M spectra occurs within the N spectra; and

calculating a second metric value for each of the M spectra, wherein the second metric value combines the frequency of occurrence of each of the M spectra within the N spectra with a first metric value for each of the M spectra, wherein the M spectra having the largest second metric value is the at least one candidate endmember.

Furthermore, the subject matter claimed in the instant application is fully disclosed in the U. S. Patent No. 6,741,740 and is covered by the patent since the patent and the application are claiming common subject matter as follows:

The subject matter recited in Claims 27-42 of the instant application is a broad version and encompasses all limitations of Claims 1-21 of U.S. Patent 6,741,740.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 28 recites the limitation "a second criteria threshold" in Lines 1 and 2.

There is insufficient antecedent basis for this limitation in the claim. "A first criteria

threshold” has not been recited in Claims 27 (the independent claim that Claim 28 depends on), or in Claim 28.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 27, 29, 31-33 and 35-41, are rejected under 35 U.S.C. 103(a) as being unpatentable over Yi-Hsing Tseng (Spectral Mixture Analysis of Hyperspectral Data) in view of Eugene W. Martin (Measurement of Impervious Surface Area from Landsat Thematic Mapper Data using Spectral Mixture Analysis).

Regarding Claim 27, Yi-Hsing Tseng disclose a process for determining at least one candidate spectral endmember within an image composed of multiple pixels of spectral data comprising:

unmixing the spectral data within each of the multiple pixels into matched spectral data and unmatched spectral data, the matched spectral data being determined based on spectral data that matches at least a first criteria (Section 2, Spectral Unmixing Based on the Linear Mixture Model; Formulas (1) and (2));

defining a metric value range, wherein the unmatched spectral data having first metric values within the metric value range are defined as candidate spectra (Section 2, Formulas (1) and (2), Error Value E_i);

comparing each of the candidate spectra, beginning with the candidate spectra having the highest first metric value, to the unmatched spectral data, to determine the frequency with which each of the candidate spectra occurs within the unmatched spectral data (Section 2, Formulas (1) to (3). F_j is the frequency that j^{th} endmember occurs within the image composed of multiple pixels of spectral data; Figure 11; Section 5, "Spectral unmixing Analysis", Forth Paragraph. For each sample data, the fraction coefficients are calculated by using constraint least square method (CLS).); and

calculating a second metric value for each of the candidate spectra, wherein the second metric value combines the frequency of occurrence of each of the candidate spectra within the unmatched spectral data with a first metric value for each of the candidate spectra, wherein the candidate spectra having the largest second metric value is the at least one candidate endmember (Figure 12; Section 5, "Spectral unmixing Analysis", Forth Paragraph The second metric value is the weighting factors in the weighted least squares computation for each of the N spectra.).

Yi-Hsing Tseng does not specifically disclose ordering the candidate spectra from highest first metric value to lowest first metric value.

Eugene Martin discloses a process of determining candidate spectral endmembers from a source multispectral image using spectral mixture analysis comprising:

ordering the candidate spectra from highest first metric value to lowest first metric value (Endmember Selection, Table 1).

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It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Yi-Hsing Tseng invention according to the teachings of Eugene Martin to order the candidate spectra from highest first metric value to lowest first metric value because it will expedite the process of spectral mixture analysis and reduce the processing time and the storage requirement for determining candidate spectral endmembers.

Regarding Claim 29, Yi-Hsing Tseng further discloses the process according to Claim 27, wherein the first criteria is first endmember spectra (Section 2, Spectral Unmixing Based on the Linear Mixture Model; Formulas (1) and (2)).

With regards to Claim 31, arguments analogous to those presented for Claim 27 are applicable to Claim 31.

With regards to Claim 32, arguments analogous to those presented for Claim 29 are applicable to Claim 32.

Regarding Claim 33, Eugene Martin further discloses a process of determining candidate spectral endmembers from a source multispectral image using spectral mixture analysis comprising calculating a root mean square (RMS) error value for each of the multiple pixels by combining the error values for the unmatched spectral data (Pages 4-6, Endmember Selection. Prospective endmember performance was compared through the scattered plots of the resulting fraction images along with the root-mean-square (RMS) values from each mixture.).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Yi-Hsing Tseng invention according to the teachings of

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Eugene Martin to implement further limitation of Claim 33 because it is a conventional procedure routinely implemented in the art for evaluating image processing errors.

Regarding Claim 35, Yi-Hsing Tseng does not specifically disclose the process according to Claim 32, wherein the first endmember is a shade endmember and further wherein the shade endmember is determined by a pre-selected baseline percentage of reflectance.

Eugene Martin discloses a process of determining candidate spectral endmembers from a source multispectral image using spectral mixture analysis wherein the first endmember is a shade endmember and further wherein the shade endmember is determined by a pre-selected baseline percentage of reflectance (Pages 4 and 5, Endmember Selection, Shade Proxy, Table 1).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Yi-Hsing Tseng invention according to the teachings of Eugene Martin to consider the first endmember a shade endmember and wherein the shade endmember is determined by a pre-selected baseline percentage of reflectance because it will normalize the effects of texture and variations in illumination caused by topography (Eugene Martine, Page 7, Post Integration Processing).

Regarding Claim 36, Yi-Hsing Tseng further discloses the process according to Claim 32, wherein the first endmember is a vegetation endmember and further wherein the vegetation endmember is determined by comparing scene spectral data for the multiple pixels to a known set of vegetation spectra (Abstract; Section 2, Formula (1); Section 4, Test Data).

Regarding Claim 37, Yi-Hsing Tseng further discloses the process according to Claim 36, wherein the step of comparing the scene spectral data for the multiple pixels to a known spectral data utilizes at least one spectral mapping algorithm (Abstract; Section 2, Spectral Unmixing Based on the Linear Mixture Model. Spectral Mixture Analysis has been utilized as the spectral mapping algorithm.).

Regarding Claim 38, identifying a predetermined number of pixels is a well-known procedure in image processing. The number of multiple pixels of spectral data is an engineering design choice.

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the relied upon prior arts of record to consider a predetermined number of 500 pixels as the number of multiple pixels of spectral data for determining endmembers because it is a conventional methodology routinely implemented in image processing.

With regards to Claim 39, arguments analogous to those presented for Claim 38 are applicable to Claim 39, signifying that the pre-selected baseline percentage of reflectance being at most 1 percent is an engineering design choice.

Regarding Claim 40, Yi-Hsing Tseng further discloses the process according to Claim 31, wherein the scene spectral data is hyperspectral data (Abstract).

Regarding Claim 41, Yi-Hsing Tseng further disclose the process according to Claim 31, wherein the unmixing is linear (Section 2, Spectral Unmixing Based on the Linear Mixture Model).

7. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yi-Hsing Tseng (Spectral Mixture Analysis of Hyperspectral Data) further in view of Eugene W. Martin (Measurement of Impervious Surface Area from Landsat Thematic Mapper Data using Spectral Mixture Analysis and Slater et al (U.S. 6,008,492).

Neither Yi-Hsing Tseng nor Eugene Martin discloses further limitations of Claim 34.

Slater et al disclose a hyperspectral imaging method and apparatus for determining materials (endmembers) in a multispectral image wherein the step of comparing the error value for each of the unmatched spectra to a predetermined error value range, wherein spectra having error values within the predetermined error value range are defined as M spectra includes:

determining an acceptable range of deviation from the mean RMS error (Column 16, Lines 55-58);

comparing each of the RMS error values for each of the N pixels to the acceptable range of deviation from the mean RMS error and keeping the M pixels that are within the acceptable range (Column 16, Lines 55-58).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify Yi-Hsing Tseng and Eugene Martin combination according to the teachings of Slater et al to implement further limitation of Claim 8 because it is a conventional procedure routinely implemented in the art for evaluating image processing errors (Thresholding).

8. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over

Yi-Hsing Tseng (Spectral Mixture Analysis of Hyperspectral Data) further in view of Eugene W. Martin (Measurement of Impervious Surface Area from Landsat Thematic Mapper Data using Spectral Mixture Analysis) and ENVI Tutorial # 10 (Advanced Hyperspectral Analysis).

Regarding Claim 42, Yi-Hsing Tseng and Eugene W. Martin do not explicitly disclose a non-linear unmixing process.

ENVI Tutorial # 10 discloses an advanced hyperspectral analysis comprising a non-linear unmixing process (Pages 12-13, Background: Unmixing).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the relied upon prior arts of record to consider a non-linear unmixing process because it will provide more realistic results and will encompass the non-linear small-scale intimate mixtures as well.

Allowable Subject Matter

9. Claims 28 and 30 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, and rewritten to overcome minor informalities set forth in this Office Action.

Claim 28 of the instant invention recites the process according to Claim 27, further comprising applying a second criteria threshold spectral mask to the unmatched spectral data within each of the multiple pixels to determine a subset of pixels whose unmatched spectral data is below the second criteria threshold; defining a metric value

range, wherein the unmatched spectral data from the subset of pixels having first metric values within the metric value range are defined as candidate spectra;

ordering the candidate spectra from highest first metric value to lowest first metric value;

comparing each of the candidate spectra, beginning with the candidate spectra having the highest first metric value, to the unmatched spectral data from the subset of pixels, to determine the frequency with which each of the candidate spectra occurs within the unmatched spectral data from the subset of pixels; and

calculating a second metric value for each of the candidate spectra, wherein the second metric value combines the frequency of occurrence of each of the candidate spectra within the unmatched spectral data from the subset of pixels with a first metric value for each of the candidate spectra, wherein the candidate spectra having the largest second metric value is the at least one candidate endmember.

Claim 30 depends on Claim 28, and is therefore allowable.

The features identified are neither discussed nor suggested by the prior arts of record.

Other prior art cited

10. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patent 6,075,891 to Burman is cited for non-literal pattern recognition method and system for hyperspectral imagery exploitation.

Contact Information

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mehrdad Dastouri whose telephone number is (703) 305-2438. The examiner can normally be reached on Monday to Friday from 8:00 a.m. to 4:30 p.m..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mehrdad Dastouri
Primary Examiner
Group Art Unit 2623
October 18, 2004

MEHRDAD DASTOURI
PRIMARY EXAMINER

Mehrdad Dastouri